advance of the storm center heavy snow fell in the middle-western States and from the upper Mississippi Valley over the Lake region and the interior of the North Atlantic States. Special warnings of heavy snow were telegraphed throughout the districts named on the 7th and 8th, and advices were also given in connection with the marked fall in temperature which followed the passage of the storm, and of the high winds which it caused along the Atlantic coast.

A third well-marked storm appeared over California on the 8th; rain, however, set in along the coast on the 7th, and during the night of the 7th the rain became general and heavy over the State, with snow in the mountain districts. By the morning of the 9th the center of this disturbance had shifted to a position off the southern California coast, whence it apparently passed eastward over northern Mexico during the 10th. On the morning of the 9th killing frost occurred in central and northern California, and on the 10th special frost warnings were issued for southern California and Arizona. Heavy to killing frosts occurred generally in southern California on the morning of the 11th.

On the morning of the 23d the following special warning was telegraphed to Jacksonville, Fla., with instructions to give it the widest possible distribution throughout the State:

Temperature will fall to-night to a minimum of between 20° and 25° at Jacksonville, and to freezing as far south as Tampa, with frost extending somewhat south of the latitude of Jupiter.

Frost occurred as predicted, and the minimum at Tampa, Fla., the night of the 23d was 32°.

The following report on the cold wave warning has been made by Mr. A. J. Mitchell, official in charge United States Weather Bureau office, Jacksonville, Fla.

Referring to the cold wave warnings on the 23d and 24th ultimo, and the disposition made of the same by this office, I have the honor to report that action was taken immediately on the receipt of your telegram, with the view of widely disseminating the information. Nearly three hundred telegrams were sent from this office, which, in conjunction with the energetic measures taken by the various railways in the State, resulted in a gratifying distribution of the warnings throughout the State. Although the warnings were fully verified, it is, nevertheless, a cause for congratulation that minimum temperatures were not such as to prove disastrous to the very large fruit and vegetable interests in this State. As indicated by the phraseology of the message, freezing weather prevailed as far south as Tampa, Fla., with a sharp frost southward to Dade County. Past experience has taught fruit and vegetable growers that the month of February is a hapless one for their interests, and the far reaching measures put in force with the view of protecting crops, amply testify to the necessity for the same, as well as their abiding faith in the forecasts and warnings of the Weather Bureau. Protective measures, now employed in this State, are such that had extremely cold weather prevailed, the amount saved would have been enormous. Thousands of tents and sheds are available in north and north-central portions of the State, while quantities of fuel were conveniently placed in the southern section, where the degree of cold is decidedly less, and where open fires have proven sufficiently efficacious. The reports from orange and vegetable growers show that they were prepared to protect, by the methods mentioned above, fruits and vegetables valued at $750,000. The value of orange bloom, vegetables, and strawberries actually saved by the warning is placed by them at $105,550. This is a small sum compared with the amount which would have been saved, had the cold wave been one of great and prolonged intensity. A few excerpts from the many reports received may show how firmly the weather service is established in this State. The official in charge feels secure in asserting that the relation of the Weather Bureau to the various interests of Florida is that of a vital organ to the human system.

"All bloom and new growth were saved under tents and sheds."

"A few degrees colder or a longer duration of cold would have killed trees without protection. The warning saved them."

"Warnings were effectual in saving thousands of dollars. Thanks."

"The service is greatly appreciated."

"Many beans would have remained unprotected but for the warning. Do not fail to continue the service."

"Everything was saved. The weather service is of great benefit."

"Warning saved a large quantity of berries.

"Vegetable growers appreciate and are governed very much by the service."

"Everyone was prepared to protect, and the warning concentrated the forces."

"I consider the warnings of the greatest importance."

"Weather reports are of incalculable benefit to our people."

"The warning was of very great value. Weather reports are very much appreciated here."

"Please continue sending special reports."

"It is worth a great deal to this vicinity to get these reports. I hope they will be continued."

"Warnings are valuable as they have saved much to growers."

"Our people watch this office every day for reports, and would be greatly disappointed to have them discontinued. They are a great help to us."

"The warning enabled us to 'fire' and otherwise protect two hundred acres of young grove, saving even the tenderest growth."

"People here appreciate weather reports and wait for them daily."

"The value of the service is amply demonstrated."

"Reports are looked for very anxiously daily."

"People appreciate these reports and wait for them."

"Weather forecasts are of inestimable value to orange growers. Without them we might as well give up business."

"Warnings are very profitable to orange growers and 'truckers.'"

"I want to express our estimate of the value and also our high appreciation of the excellent service of the Weather Bureau. The success of the orange industry in this vicinity depends largely upon you. I want to thank you, also, for the daily charts. I find them valuable, and feel that they are indispensable to the success of my operations here."

The manner of disseminating frost warnings and the methods employed in protecting fruit from frost in Florida is described as follows in the Chicago Record of February 28, 1901:

Bellair, Fla., February 25.—The United States Weather Bureau people sent a bulletin into Florida on Saturday last which created the greatest activity among the army of orange and pineapple growers from the Georgia line to Key West. The Weather Bureau predicted that there would be a freeze as far south as Tampa, and frost farther south. Twenty minutes after the warning came thousands of teams were galloping along the roadways leading to pine forests. There was such a bustle as one sees after a fire alarm has been struck. The wagons were loaded with pine knots, logs, and wood of all kinds and hauled at a run to the orange orchards. The stuff is arranged in piles north of the orchard and set on fire. Thousands of acres of fruit trees were saved by this kind of night work, which was general all over the orange-growing sections.

Still another army of workers were made busy by the weather bulletin. They were the men, women, and children who attend to the orange tree tents, for thousands of orange trees are now protected by canvass which covers the whole tree. In fine weather the canvass is rolled back so that the tree is exposed to the sunshine, but when Professor Moore sends his note of warning a whole household will sally forth to close up the tents. Inside the tent one or two kerosene lamps are lighted, which sufficiently heat the air to prevent a freeze. The same warning serves to interest the pineapple people. Their patches of plants are mainly inclosed and covered with slats nailed on stringers 6 feet overhead. The space between the slats lets in the sunshine during fine weather. When a cold wave is signaled the "hands" run out a canvass screen which slides on wires just under the slats, working on the principle of a shade in a photograph gallery. By means of these screens an acre—indeed sometimes five or six—are closed up and the plants kept snug and warm by means of fires lighted in different places within the inclosure.

A period of heavy rains began in the North Pacific coast States on the 12th and continued through the 15th, causing slight freshets in the Willamette River and tributaries. These rains attended the passage of areas of low barometer eastward over British Columbia on the 13th and 15th. Heavy rains and warm weather about the middle of the month also caused a marked rise in the rivers of California. The rises in the rivers of the Pacific slope were anticipated by special warnings.

CHICAGO FORECAST DISTRICT.

The first storm of the month crossed the southern Rocky Mountain region on the 2d, and its center moved forward along the middle Mississippi and Missouri valleys during the 3d. It was accompanied by unusually heavy snow and high winds in portions of the Missouri and middle Mississippi valleys and the upper Lake region. Warnings of heavy snow were issued on the evening of the 2d, and on the morning of the 3d supplementary messages were sent out containing ad-

ditional information regarding cold weather. The second storm moved across the Rocky Mountains on the 7th, and over the central valleys on the 8th. This storm caused more extensive precipitation than the preceding one. Heavy snow warnings were issued in advance of the movement of the storm, and were completely verified.

The Bureau received warm commendation from all sides for the excellent work done in connection with these two large snowstorms.

The movement of cold waves in the district during the month was generally gradual, but when sudden changes occured warnings were given well in advance. The temperature forecasts were carefully followed by shippers of perishable goods and transportation companies and were of much value. Long range forecasts for continued cold weather were made frequently with much success.—*H. J. Cox, Professor.*

Under date of February 21, in its editorial columns, the Chicago Chronicle said:

Our compliments to the gentleman in the tower of the Auditorium Hotel upon the accuracy of his prognostications during the last three weeks or so. No better example of the science of weather forecasting could be desired. Every prediction has been entitled to be marked "verified," even to the very difficult feat of foretelling the temperature during the night. We doubt if the month's record of the local forecaster has been equaled anywhere since the establishment of the Weather Bureau. It certainly has not been excelled, because no higher excellence is possible than the fulfillment of all predictions.

SAN FRANCISCO FORECAST DISTRICT.

Killing frosts occurred generally in southern California on the morning of the 2d and were accurately forecast. A succession of low areas passed rapidly southward on the Pacific coast during the first week in February. These were accompanied by general and heavy rains. Advisory messages were sent to Los Angeles and San Diego on the morning of the 5th, of high southerly winds. These were verified. On Sunday, February 10, special frost warnings were issued for southern California and Arizona. Heavy to killing frosts occurred in southern California on the morning of the 11th. Heavy rains occurred over northern California. Combined with warm weather, these gave the forecast official reason to believe that a marked rise in the rivers would occur in a few days. Special warnings were sent to Colusa. On the morning of the 20th special river reports were called for from all points along the Sacramento River. Reports of the condition of the rivers were published and warnings of high water in the Basin were distributed generally through the press. The Sacramento River continued to rise, reaching a crest of 28.2 feet on February 25. The crest of the flood was accurately forecast.—*A. G. McAdie, Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

No severe storms or other unusual weather conditions occurred in this district during the month.

Brisk and high winds of short duration occurred along the Washington coasts on several occasions, all of which were successfully forecast.

Heavy rains from the 13th to the 16th caused a slight rise in the Willamette River and tributaries, and forecasts covering the expected rise were issued from the 14th to the 20th.—*A. B. Wollaber, Acting Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	2, a.m.	39	83	3, a.m.	43	74	525	1.0	525	21.9
II	2, p.m.	53	108	7, a.m.	39	82	1,950	4.0‡	488	20.3
III	7, a.m.	53	122	8, p.m.	50	97	1,075	1.5	717	29.9
IV	8, a.m.	41	105	11, a.m.	38	78	1,650	2.5‡	620	25.8
V	9, p.m.	54	114	14, a.m.	48	85	1,375	3.0§	458	19.1
VI	14, a.m.	48	125	15, p.m.	50	99	1,200	1.5	800	33.3
VII	17, a.m.	53	121	22, a.m.	21	71	3,775	4.0†	944	39.4
VIII	22, p.m.	35	102	25, p.m.	32	64	2,400	3.0	800	33.3
IX	27, a.m.	42	93	1, a.m.*	32	64	1,750	2.0	875	36.5
Sums							15,600	22.5	6,227	259.5
Mean of 9 paths							1,733		692	28.8
Mean of 22.5 days									693	28.9
Low areas.										
I	1, a.m.	33	115	9, a.m.	48	54	3,900	7.0†	557	23.2
II	2, a.m.	47	123	11, a.m.	48	54	4,600	9.0	511	21.3
III	7, a.m.	26	97	9, p.m.	33	65	2,100	1.5†	1,400	58.3
IV	7, p m.	40	122	10, p.m.	33	115	850	2.5‡	340	14.2
V	9, a.m.	53	114	11, a.m.	47	88	1,300	2.0	600	25.0
VI	13, a.m.	49	123	16, p.m.	40	75	2,800	3.5	800	33.3
VII	15, a.m.	49	123	18, a.m.	48	89	1,875	3.0	625	26.0
				18, a.m.	41	74	2,825	3.0	942	39.2
VIII	18, a.m.	33	97	20, a.m.	33	65	1,900	2.0	950	39.6
IX	18, p.m.	41	124	20, a.m	49	123	600	1.5	400	16.7
X	21, a.m.	40	105	25, a.m.	48	54	4,000	4.0	1,000	41.7
XI	21, p.m.	40	109	22, p.m.	32	107	575	1.0	575	24.0
XII	24, a.m.	48	85	28, a.m.	48	54	1,650	3 0†	550	22.9
XIII	23, p.m.	34	112	26, a.m.	28	82	2,000	1.5†	1,333	55.6
XIV	27, p.m.	38	100	2, p.m.*	32	65	2,450	3.0	817	34.0
Sums							33,325	47.5	11,400	475.0
Mean of 15 paths							2,222		760	31.7
Mean of 47.5 days									702	29.2

* March. †Stationary for 1 day. ‡Stationary for ½ day. §Stationary for ⅓ days.

RIVERS AND FLOODS.

River matters were dull and almost entirely uneventful during the month. Stages, as a rule, were somewhat lower than during January, 1901. A few minor flood warnings were issued in the southern districts from the 4th to the 9th. Nothing serious was anticipated and no damage of consequence occurred. The rivers of the Pacific coast system were also comparatively high during the third week of the month, owing to heavy rains, and stages close to the danger lines were reached. Cautionary advices regarding these rises were issued by the officials in charge of the Weather Bureau offices at San Francisco and Portland.

Ice conditions remained practically unchanged, except in the upper Mississippi River, where the line of total freezing moved southward to below Davenport, Iowa. The Ohio River at Wheeling, W. Va., closed on the 24th, and at the end of the month a gorge still held near the lower portion of the city, although the river was clear above. There was much floating ice along the entire river during the greater portion of the month, but very little in the Mississippi River below the mouth of the Ohio.

The highest and lowest water, mean stage, and monthly range at 132 river stations are given in table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*